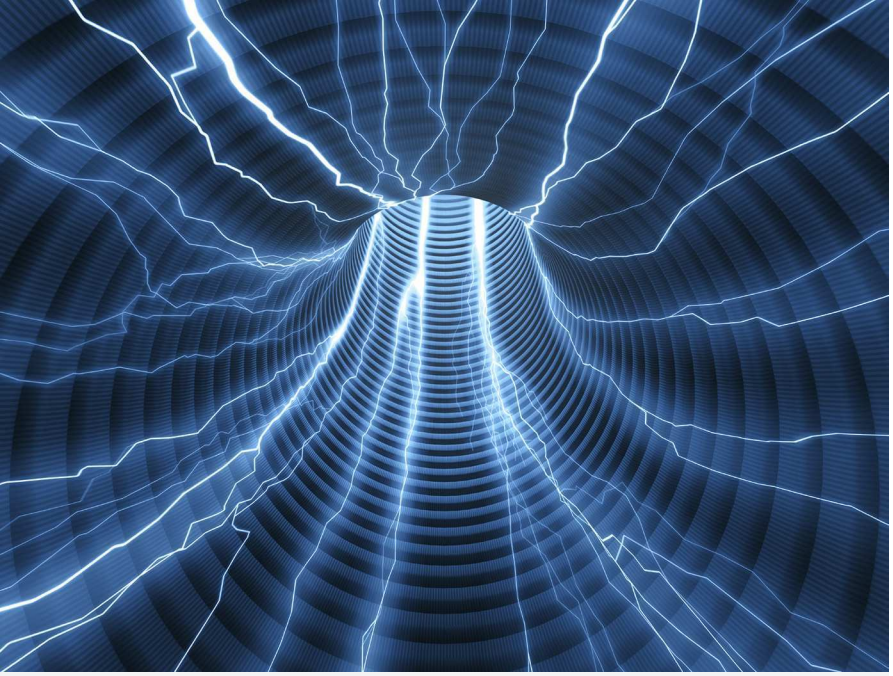


National Aeronautics and Space Administration

Power Generation and Storage

Fuel Cell Power Management Technique

Produces multiple voltages simultaneously from a single fuel cell stack without the need for converters

An innovation from the NASA Glenn Research Center increases the efficiency and versatility of fuel cell stacks for power generation. To meet the requirements of a fuel cell system, engineers have typically added direct-current-to-direct-current (DC-to-DC) converters that reduce the voltage produced at the ends of the fuel cell stack. This smaller voltage is then used to operate the valves, pumps, heaters, and electronics that make up the fuel cell system. However, adding DC-to-DC converters increases cost, reduces efficiency, adds to the system part count (which reduces reliability), and increases both the mass and volume of the fuel cell system. NASA's innovative technique features multiple power points that connect different numbers of cells in an electrical series, allowing the fuel cell stack to produce electrical power at multiple DC voltages simultaneously. This capability eliminates DC-to-DC converter electronics, thereby reducing cost and simplifying the system.

BENEFITS

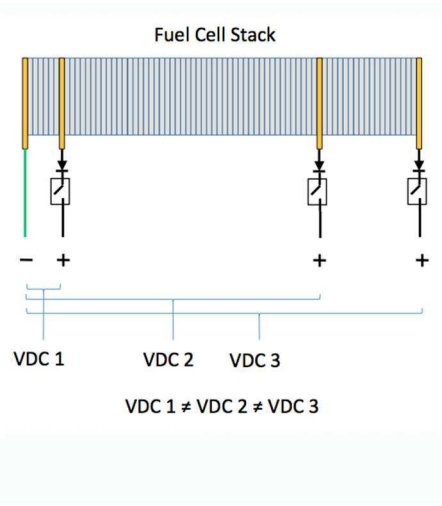
- Less costly: Fuel cell systems can be built without the added cost of converters
- More efficient: This technique eliminates the need for an additional step in the process of generating usable power from fuel cells
- More reliable: This improvement decreases the part count within the design, thus reducing the number of potential points of failure in the system
- Reduced size: Removing the converters decreases the mass and volume of the overall system

technology solution

THE TECHNOLOGY

In general, individual fuel cells produce relatively small electrical potentials, so fuel cells are stacked or placed in series (anode to cathode) to increase the combined voltage and meet the application's requirements. The current is drawn off by connection points, which typically are at the extreme ends of the fuel cell stack. DC power converters reduce the voltages produced at the ends of the stack into voltages that can be used by attached devices. However, these converters add cost, mass, volume, and potential failure points into the fuel cell system.

With NASA Glenn's groundbreaking technique, the fuel cell stack includes a plurality of connection points instead of featuring them only at the ends of the stack, which allows the system to be tailored to produce the required combinations of voltages for desired applications. Initially, this plurality includes a ground, a first connection point, and a second connection point. Additional connection points can be added as needed, resulting in various voltages that are available for use. Each connection point draws a specified voltage based on the combined voltages of the fuel cells located between the connection point and the ground. This configuration permits the voltage to be adjusted to the system requirements of multiple devices or applications simultaneously without the need to add DC power converters to the fuel cell stack. For larger fuel cell configurations in particular, NASA's innovative technique results in a far less costly, more efficient means of power generation.



Fuel cell stack with multiple connection points

Fuel-cell-powered vehicle

APPLICATIONS

The technology has several potential applications:

- Energy generation and storage in rural areas
- Spacecraft and weather stations
- Communications centers
- Military applications (portable, vehicle, naval, aerospace)
- Cogeneration power for residential and commercial use
- Emergency power systems

PUBLICATIONS

Patent Pending

More Information

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NP-2015-04-1534-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

LEW-19041-1